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Dublin, Louis Israel

An experiment in the compilation of mortality...

[New York]

[1913]

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An experiment in the compilation of mortality statistics... by Louis I. Dublin... Edwin W. Kopf...
p. 639-647. tables.
[New York, Metropolitan Life Insurance Co., 1913]
Reprinted from the Quarterly publications of the American statistical association, December, 1913.

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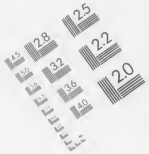

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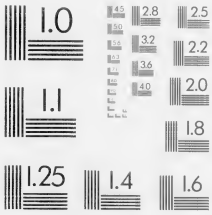

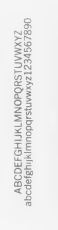

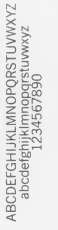

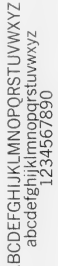

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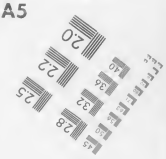

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An Experiment in the Compilation of Mortality Statistics

Reprinted from the Quarterly Publications of the AMERICAN STATISTICAL ASSOCIATION, December, 1913

BY

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AN EXPERIMENT IN THE COMPILATION OF MORTALITY STATISTICS.

By Louis I. Dublin, *Statistician,* Edwin W. Kopf, *Chief Clerk, Statistical Bureau, Metropolitan Life Insurance Company.*

The compilation of accurate mortality statistics by cause of death presents many serious practical difficulties. The chief element of error lies in the inaccuracy of the statement of cause as reported, in the first instance, by the physician. We need but recall the work of Cabot,* and more recently, that of Oertel,† who point out that in the best hospitals, bedside diagnoses of even the commoner maladies often prove to be erroneous on autopsy. Thus, in Cabot's cases, where the cause had been stated as chronic interstitial nephritis, one half showed, on autopsy, no lesion of the kidney at all. As a further illustration of this error factor, we can point to numerous instances where physicians for one reason or another deliberately withhold a statement of the true cause of death when the condition is either tuberculosis, cancer, syphilis or suicide.

The second large element of error arises from the incomplete statement of cause of death through the unintentional failure of the physician to state all the morbid conditions known to him which resulted in the death. Thus, it is still customary for physicians to be content with a statement of "Acute Nephritis" as a cause of death, neglecting altogether to refer to the "Scarlet Fever" which terminated in the "Acute Nephritis." Physicians often report "Meningitis" as a cause when there has been a primary condition, such as "Whooping-Cough" or some form of traumatism antecedent to the final condition. The violences are especially subject to indefinite statement, no reference being made in many instances to such socially significant factors in the death, as homicide, suicide and the means of injury. It is the purpose of this paper to present the results of an experiment conducted by our

* Cabot, Richard C., M. D.: Diagnostic Pitfalls Identified during a Study of Three Thousand Autopsies, Journal Amer. Medical Ass'n, December 28, 1912.

† Oertel, Horst, M. D.: The Inaccuracy of American Mortality Statistics, American Underwriter, May, 1913.

office, to reduce to a minimum this important secondary element of error. After two years of operation, there has been evolved a definite routine which appears to have sufficient merit to warrant the consideration of vital statisticians.

The technical procedure is as follows: The compiling clerks engaged in classifying causes of death, carefully examine the death certificates attached to the claim papers and determine whether the statement as given by the physician is satisfactory and complete. Statements of cause presenting no difficulty are at once classified according to the International List of Causes of Death. Causes which are jointly returned are classified according to the precedents and rules of the International Committee, as best exemplified by the methods of the United States Census Bureau. Wherever the statement of cause, as given, is considered unsatisfactory for classification or where from the claimant's statement or from other sources, there is an indication of the presence of a serious condition contributing to the death, and not mentioned on the certificate, a letter of inquiry is sent to the physician asking for the additional facts.

At the beginning, we proceeded cautiously and asked only for information as to the means and character of injury in cases of ill-defined violence. We also queried "Operations" for their causes; the causes contributing to "Peritonitis," and for the location of "Cancers" and "Tumors." We asked for additional information when the terms were "Dropsy," "Heart Failure," and others of like character which are included in the designation, "Ill-defined Diseases" in the International Classification. Later, we extended our field of inquiry, and, at present, we write to physicians in the following instances:

LIST OF UNDESIRABLE RETURNS AND CHARACTER OF INQUIRY MADE.

Undesirable Returns.	*Inquiry.*
I. "Injury," "Gunshot-Wound," "Drowning," "Accidental Death," or other ill-defined violence.	Was death due to suicide, homicide or accident, and if the last, what *kind* of accident was the primary cause of death? (steam railroad, street car, fall, etc.).
II. "Operation," "Hysterectomy," "Laparotomy."	What was the cause for the relief of which the operation was performed?
III. "Peritonitis."	Was the peritonitis secondary to typhoid fever, tuberculosis? If post-operative, what was the primary cause? Suicidal? Homicidal? Accidental? If last, means of injury?
IV. "Acute Nephritis."	Kindly indicate the primary cause of the acute nephritis. Due to any contagious or infectious disease? (Scarlet fever, typhoid fever, etc.) *Directly* due to alcoholism or exposure? Traumatic? If so, means of injury?
V. "Meningitis," or "Cerebrospinal Meningitis."	Was it *epidemic* cerebrospinal meningitis? Tuberculous? Was it simple meningitis following lobar pneumonia, typhoid fever, any contagious or infectious disease? Traumatic? If so, means of injury. Suicidal, homicidal or accidental?
VI. "Paralysis."	Was the paralysis superinduced by cerebral hemorrhage? Was it a case of spinal paralysis?
VII. "General Paralysis of the Insane."	Was it luetic?
VIII. "Locomotor ataxia."	Kindly inform us whether the origin of the locomotor ataxia was luetic? Traumatic? If so, means of injury?
IX. "Progressive Paralysis."	Was this "progressive paralysis" due to a spinal lesion? Was it directly, or remotely, due to cerebral hemorrhage?
X. "Cancer," "Tumor," "Abscess."	Kindly indicate the location of the .....
XI. "Burns."	Was death primarily due to burns received in burning building? Such deaths are separately classified.
XII. Any terminal condition of uncertain origin: "Septicemia," "Convulsions," "Hemorrhage."	Kindly indicate the primary cause of the.....

In addition, we ask physicians whether serious conditions affecting the lungs, heart or kidney were involved whenever there are indications in the claimant's statement, or in our other sources of information, that such lesions contributed to the death. Claimants also often refer to the presence of "Measles," "Scarlet Fever," "Whooping Cough," when no such reference is made upon the physician's certificate. Each of these is queried.

These queries are suggested on pp. 42 and 43 of the 1909 revision of the Manual of the International List issued by the Bureau of the Census. A similar system of inquiry is maintained by a number of State Registry Offices in this country. The Registrar General of England and Wales has directed his attention to this method of improving defective statements of causes of death and has reported his experience in the annual reports of his office.

At the present time, we are querying close to 8 per cent. of the death certificates received, or about 9,200 cases in a total of 115,000 deaths per year. Our letter is a request to the physician in which we point out that the claim has been paid, and appeal for the added information on the ground of scientific interest in the improvement of vital statistics. It is a pleasure to acknowledge in this place our obligation to the many busy men throughout the country who have responded promptly and fully to our letters. In many instances, physicians have entered enthusiastically into the spirit of the inquiry and have given us a complete clinical history of the case which it would have been impossible to enter upon the death certificate. The data presented in the following tables are based upon an analysis of 5,118 replies received from physicians up to October 1st, 1913.

Table I shows the distribution of these replies according to the original assignment of cause of death, together with the number and percentage of change in classification which resulted from the inquiry:

TABLE I.

CHANGES IN CLASSIFICATION OF CAUSE OF DEATH RESULTING FROM INQUIRY TO PHYSICIANS.

International List Number.	Original Assignment of Cause of Death.	Number of Replies.	Changes in Assignment.	
			Number.	Per Cent.
020	Purulent Infection and Septicemia	59	46	78.0
045	Cancers of Organs not specified	103	79	76.7
061	Simple Meningitis	437	325	74.4
066	Paralysis without specified cause	285	259	90.9
079	Organic Diseases of the Heart	184	56	30.4
081	Diseases of the Arteries	124	69	55.6
092	Pneumonia	166	69	41.6
117	Simple Peritonitis	213	180	84.5
119	Acute Nephritis	548	227	41.4
120	Bright's Disease	184	64	34.8
154	Senility	50	25	50.0
167	Burns (conflagrations excepted)	317	54	17.0
170	Traumatism by Firearms	51	44	86.3
185	Fractures (Cause not specified)	403	365	90.6
188	Other External Violence	224	187	83.5
189	Ill-defined	145	114	78.6
	All other titles	1,625	664	40.9
	Total	5,118	2,827	55.2

It is evident from Table I that comparatively few causes contributed the largest number of the unsatisfactory assignments although virtually every title in the International List appeared in the original returns which we queried. Thus, the sixteen causes given in Table I make up 68 per cent. of the total. The largest amount of change is, moreover, found in these sixteen titles varying from 90.9 per cent. in "Paralysis," to 17 per cent. in "Burns." In all, 2,827 changes in assignment were recorded, or 55.2 per cent. of all the replies received. The value of the method for increasing the accuracy of mortality statistics should, therefore, be apparent.

Conditions of considerable medical and social interest are often masked by the undesirable titles. As in the case of "Simple Meningitis," an analysis of the replies shows that assignments were ultimately made to such definite causes as "Tuberculous Meningitis" and "Epidemic Cerebrospinal Meningitis." Similar conditions are found upon query and analysis of such indefinite titles as "Paralysis," "Peritonitis," and "Fractures." Table II (a), (b), (c), (d), shows the detailed changes in classification in the titles "Meningitis," "Paralysis," "Peritonitis," and "Fractures," respectively.

TABLE II.

CHANGES IN ASSIGNMENT OF CAUSE OF DEATH FOR THE RETURNS *"SIMPLE MENINGITIS," "PARALYSIS WITHOUT SPECIFIED CAUSE," "SIMPLE PERITONITIS," AND "FRACTURES (CAUSE NOT SPECIFIED)."*

Undesirable Term.	Changed to Title.	Number.	Per Cent. of Total.
(a) Simple Meningitis. [Total Replies: 437]	Typhoid Fever	8	1.8
	Measles	7	1.6
	Influenza	10	2.3
	Tuberculous Meningitis	59	13.5
	Syphilis	9	2.1
	Epidemic Cerebrospinal Meningitis	92	21.1
	Bronchopneumonia	19	4.3
	Diarrhea and Enteritis	30	6.9
	Traumatism by Falling	13	3.0
	Other titles	78	17.8
	Total changes	325	74.4
(b) Paralysis without specified cause. [Total Replies: 285]	Syphilis	5	1.8
	Acute Anterior Poliomyelitis	38	13.3
	Cerebral Hemorrhage	188	66.0
	General Paralysis of the Insane	11	3.9
	Other titles	17	6.0
	Total changes	259	90.9
(c) Simple Peritonitis. [Total Replies: 213]	Typhoid Fever	8	3.8
	Abdominal Tuberculosis	17	8.0
	Diarrhea and Enteritis	9	4.2
	Appendicitis	38	17.8
	Salpingitis and other Diseases of the female genital organs	15	7.0
	Puerperal Septicemia	30	14.1
	Criminal Abortion	2	.9
	Other Titles	61	28.6
	Total changes	180	84.5
(d) Fractures: (Cause not specified.) [Total Replies: 403]	Traumatism by Falling	226	56.1
	Railroad Accidents	11	2.7
	Street Car and Automobile Accidents	17	4.2
	Other Vehicular Accidents	19	4.7
	Homicide by various means	9	2.2
	Other Titles	83	20.6
	Total changes	365	90.6

It is important to observe that the changes in classification noted in the preceding table agree, in the main, with the results obtained by the United States Bureau of the Census and the Registrar General's Office. Table III presents a comparison of the amounts of change in the classification of three indefinite returns for causes of death resulting from the system of inquiry in the several offices.

TABLE III.

COMPARISON OF CHANGES IN ASSIGNMENT OF CAUSE OF DEATH FOR *"SIMPLE MENINGITIS," "PARALYSIS WITHOUT SPECIFIED CAUSE," AND "SIMPLE PERITONITIS."*

Undesirable Term.	U. S. Bureau of the Census.			Registrar General's Office.			Metropolitan Life Insurance Company's Experience.		
	Number of Replies.	Number of Changes.	Per Cent. of Change.	Number of Replies.	Number of Changes.	Per Cent. of Change.	Number of Replies.	Number of Changes.	Per Cent. of Change.
"Simple Meningitis"	354	304	85.9	269	185	68.8	437	325	74.4
"Paralysis without specified cause"	235	176	74.9	1,091	854	78.3	285	259	90.9
"Simple Peritonitis"	102	79	77.5	694	408	58.8	213	180	84.5

A more detailed examination of the reports of the United States Census Bureau* and of the Registrar General's Office† shows also fair consistency both in kind and amount of change in assignment which result from inquiry. It is of interest to note, for example, that 17.6 per cent. of the "Simple Peritonitis" cases were changed into "Appendicitis" by the United States Census Bureau, 17.4 per cent. by the Registrar General's Office, and 17.8 per cent. by the Metropolitan Statistical Bureau, respectively. So, too, the United States Census Bureau returns show that 29.4 per cent. of the "Simple Meningitis" cases were changed into "Epidemic Cerebrospinal Meningitis," 34.9 per cent. by the Registrar General's Office, and 21.1 per cent by the Metropolitan Statistical Bureau, respectively.

Physicians, even to this day, are loth to report venereal diseases as causes of death. This has resulted in a decided distortion of the statistics for these causes. Thus, the returns for the Registration Area, 1911, ascribe 0.46 per cent. of the total deaths to "Syphilis" and 0.03 per cent. to "Gonococcus Infection." It is generally admitted by competent authority that these figures represent only a small part of the total deaths which should be attributed to these two causes. Our queries, especially of "Locomotor Ataxia" and "General Paralysis of the Insane," confirm the conclusions drawn by clinicians that these important conditions are chiefly syphilitic in origin.

* Mortality Statistics, Bulletin 112, pp. 34–35.

† Seventy-fourth Annual Report of the Registrar General of England and Wales, p. XCVI.

Replies received to a recent query, subsequent to those presented above, indicate that 50 per cent. of the "Locomotor Ataxia" cases which were questioned, were luetic in origin, as were 50.8 per cent. of the cases of "General Paralysis of the Insane." These percentages, moreover, are based, in every instance, on a definite statement of a positive Wassermann reaction or on the prior admission of a syphilitic personal history by the patient.

The acute infectious diseases are often hidden under such meaningless returns as "Pneumonia," "Bronchopneumonia," "Acute Nephritis" and "Myocarditis." It is noteworthy that the inquiry method is responsible for a number of transferred assignments from the foregoing indefinite titles to such as "Scarlet Fever," "Measles," "Whooping Cough" and "Diphtheria." The communal value of added returns of this character is obvious to the progressive health officer, helping to define, as they do, the scope of his communicable disease problem.

The inquiry system outlined above is still in an experimental stage in our office routine; yet, we have already observed very definite effects from its operation upon our mortality compilations. Thus, the tabulation of our Industrial mortality for the first six months of 1913 shows that we have reduced "Ill-defined Diseases" (International List Nos. 187, 188, 189) to 0.8 per cent. of the total as against 1.4 per cent. in the tabulation for the first half of 1911. So, too, we have reduced our incidence of "Acute Nephritis" to 0.8 per cent. (1913, first half) as contrasted with 0.9 per cent. for the same period of 1911. "Meningitis" likewise shows a reduction to 0.8 per cent. (first half, 1913) from 1.0 per cent. (first half, 1911). On the other hand, our registration for "Syphilis" has increased to 0.4 per cent. (for the first half, 1913) from 0.2 per cent. of the total deaths for the first half year of 1911. We have no ground whatever for assuming that there has been a change in our actual mortality experience from the above causes, and we, therefore, assume that such changes as we have shown above are to be ascribed to the more careful methods of editing which have been instituted since the tabulation of the 1911 figures.

In the last analysis, the validity of mortality statistics must depend upon the physicians who complete the death certificates. If the fundamental data transmitted by them be erroneous, no statistical method, however efficient, will compensate for the errors involved. The vital statistician can do little or nothing to remedy the situation described by Doctors Cabot and Oertel. We must look to the medical profession itself for such improvements in pathology and diagnosis which will eliminate the crude errors so often appearing as statements of cause. The vital statisticians should, of course, give active support to all movements which will raise the standard of medical education throughout the country. They can also assist in the propaganda for increasing the number of autopsies performed in our hospitals. It is to be hoped that incorrect diagnoses on the part of physicians will be reduced before long to a minimum and the accuracy of the fundamental data of mortality statistics assured.

But the vital statistician, on his own account, must not mar the returns such as he does receive because of crude methods of compilation. He must not ignore the standard practice of criticism and classification such as is used in the leading governmental registration offices of the world. In this way, his results will be made comparable with those of other offices. He must also persistently examine his material at its source to register every item of information which may be obtainable from physicians and other persons. This he now can do. By following the suggestions outlined in this paper, registrars can at once improve the quality of their tabulations to a very significant degree. Coupled with advances in pathology and diagnosis, there should be equal progress and refinement in our statistical methods. The result of both should make mortality statistics worthy of their subject and fairly indicative of what is actually transpiring in the life of the people.

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